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(54) **Information recording medium and information recording and reproducing apparatus**

Aufnahmedatenträger und Informationsaufnahme- und Wiedergabegerät

Support d'enregistrement d'information et appareil d'enregistrement et de reproduction d'information

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Description

BACKGROUND OF THE INVENTION

The present invention generally relates to an information recording medium where the data are recorded or reproduced in sectors according to the precharacterizing clause of claim 1, and an information recording and reproducing apparatus for recording or reproducing the data with the use of the information recording medium according to the precharacterizing clause of claim 5.

A ROM disk with the data being recorded previously on one portion or the whole of the information recording medium is being used with the object of distributing software and so on to many users with lower prices. The data format of the ROM disk is being standardized with 90mm rewritable optical disk provided as the subject in the Optical Disk Standardization Committee (ISO/IEC JTC1/SC23/ WG2). The contents thereof are described in the proposal N72 10090 being the closest prior art from which the present invention starts.

Fig. 8 is an area layout showing schematically the layout of each area assigned to the partial ROM disk described in the draft proposal. In Fig. 8, a rewritable area where the data recording reproducing may be performed and a ROM area where the data reproduction only may be performed are assigned within the user area where the user data are recorded. In addition to the user area, a defect management area where the control data of the user area, the defect lists are recorded, a control track area where the disk control data of the optimum laser power and so on are recoded are assigned into the specific location on the disk. Although these management data are multiple recorded on both the sides of the user area in the proposal in order to improve the reliability, it is omitted so as to simplify the description. The defect management area is composed of a primary defect list area for recording the primary defect list where the address of the defective sector detected from the rewritable area in the format processing is registered in the format processing, a secondary defect list area for recording the secondary defect list where address of the defective sector detected from the rewritable area and the address of the alternate sector are collectively registered in the data recording operation, and a disk definition area for recording the disk definition structure, where the management data of the respective area assigned onto the disk is recorded. The committee proposal defines a rewritable disk where the whole user area is a rewritable area and a ROM disk where the whole user area is a ROM area.

In the control track area and the ROM area, the concavo-convex shaped track is formed at the disk manufacturing time so as to record the information. Although the data can be read from these areas, the recorded information cannot be rewritten. As the optical characteristics in these areas are different from the rewritable area, the data recording and reproducing apparatus is required to identify the ROM area for the focus control, the tracking control, the reproducing signal processing, further the write protection function with respect to the ROM area and so on. As the existence of the ROM area and the size thereof are different depending upon the disk, the start track address and the end address are recorded within the control track area as the management data of the ROM area.

Fig 9 is an area layout of the ROM area interior formed within the user area. In Fig. 9. the ROM area is divided into a plurality of ROM groups. The ROM group is composed of data sectors with the user data being recorded on it, and parity sectors with the parity data being recorded on it. When one track is composed of 25 sectors, the most fundamental ROM group is composed of one track with the sector 0 through the sector 23 being assigned to the data sector and the sector 24 being assigned to the parity sector. At this time, the parity data to be recorded on the parity sector is defined as follows with the user data of the k th byte in the sector n being D (n, k)

$$D(24, k) = D(0,k) * D(1,k) *...* D(23,k)$$

where an operator * shows an exclusive OR operation. When, for example, the sector 0 has been detected as an uncorrectable error sector in the error correction processing, the user data of the error sector is computed from the following formula with the use of correct data read from all the other sectors to be included in the ROM group.

$$D(0.k) = D(1,k) * D(2.k) *...* D(24,k)$$

Fig. 10 is a data block diagram of a disk definition structure for managing the respective areas assigned onto the disk. A data identifier with (OAOA)h is recorded on the head for identifying that the read data is the disk definition structure. A certification flag following it is a flag showing whether or not the certification of the rewritable area has been performed in the format processing. Followed by them, the management data of the rewritable area and the ROM area assigned to the user area are recorded. The management data of ROM area includes the number of the ROM groups, the number of data sectors per group and the number of parity sectors per group. Finally, the start addresses of the respective areas are recorded as the management data of the primary defect list area and the secondary defect list area.

But in the development process of such ROM disk, the disk manufacturing step from the cutting process of the master disk having the ROM area to the disk duplication process using the stamper is carried out. Accordingly, when the manufacturing number of the ROM disks is as restricted in number as, for example, several hundreds, the manufacturing cost per disk becomes higher.

On the other hand, in the editing process of the application data, the sample ROM disk is made after the operation of the application has been confirmed on the magnetic disk drive unit. But in the operation test using the sample ROM disk, the reduction in the performance because of the difference in the data transfer speed between the magnetic disk drive unit and the optical disk drive unit or the inconvenient operation due to the bug of such application as rewrite the data on the magnetic disk may be detected. As several kinds of sample ROM disks are normally made before the operation test of the application is completely confirmed, the editing process of the ROM disk becomes longer.

In the book "MS-DOS" by J. Schieb the ATTRIB command of MS-DOS is discussed. This command is provided in order that the user of a PC sets or changes the file attribute managed using the file system of MS-DOS. The file set in the condition of Read-Only File using the command is prevented from deletion due to the user's misoperation since the file recording processes by the user are all prohibit by the file system. In more detail, when the user tries to execute an erroneous file deletion or rewriting operation on the Read-Only File, the process of the file system is proceeded with reference to the directory file stored in the "root directory area", for example, shown in Fig. 1 (b) of the present discription. The Directory Entry recorded with management information of the file to be subjected to the rewriting operation is read out of the directory file so as to be identified as the Read-Only File with reference to the file attribute. Then, the misoperation is informed to the user without issuing a DEVICE command indicating the data recording operation, for example, WRITE command onto the drive device of the information recording medium recorded with the file. As described above, the file attribute setting operation with such ATTRIB command is executed by means of the file system, and therefore the drive device per se does not identify the presence or recording area of the file of which data recording operation is prohibited based on the file attribute.

Finally, from the European Patent Application 0 350 920 a method of managing defective sectors, i.e., defect managment per se is known.

SUMMARY OF THE INVENTION

Accordingly, the present invention has been developed with a view to substantially eliminating the above discussed drawbacks inherent in the prior art and has for its essential object to provide an information recording medium, which has the function and performance equivalent to the conventional ROM disk when a small amount of ROM disk is supplied to users with lower price or when the sample ROM disk is made for a shorter time in the editing process of the ROM disk. Also, it is to provide an information recording and reproducing apparatus for making the information recording medium, and further, an information recording and reproducing apparatus for performing the recording and reproducing operation of the user data with the use of the information recording medium.

These and other objects are accomplished by the features of present claim 1. Further advantageous embodiments of that information recording medium are defined in subclaims 2 to 4.

According to another aspect of the present invention there is provided an information recording an reproducing apparatus which is connected to a host computer, which performs write operations in an area of a disk-shaped information recording medium mentioned above, and which is defined in present claim 5. Further advantageous embodiments of that recording and reproducing apparatus are defined in subclaims 6 to 8.

By the above described construction, the information recording and reproducing apparatus of the present invention prohibits the data recording operation into the virtual ROM area in accordance with the area management data read from the disk management area and also, recovers the user data of the defective sector with the use of the parity data, so that it becomes possible to perform the same data recording and reproducing operation as the conventional ROM disk with respect to the information record medium having the virtual ROM area.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an area layout of an information recording medium in a first embodiment of the present invention;

Fig. 2 is a data structure of the area management data in one embodiment;

Fig. 3 is an area layout of the information recording medium in a second embodiment of the present invention;

Fig. 4 is a block diagram of the information recording and reproducing apparatus;

Fig. 5 is a data block structure of a memory for data processing use;

Fig. 6 is a flow chart for explaining the making procedure of the information recording medium having the virtual ROM area;

Fig. 7 is a flow chart for explaining the data recording and reproducing operation from the information recording medium having the virtual ROM area;

Fig. 8 is an area layout of an information record medium in the conventional embodiment;

Fig. 9 is an area layout of the ROM area interior in the conventional embodiment; and

Fig. 10 is a data structure of the disk definition structure.

DESCRIPTION OF THE PREFERRED EMBODIMENT (S)

Before the description of the present invention pro-

ceeds, it is to be noted that like parts are designated by like reference numerals throughout the accompanying drawings.

An information recording medium of the present invention, and an information recording and reproducing apparatus for making the information recording medium, an information recording and reproducing apparatus for performing the recording and reproducing operation of the data with the use of the information record medium will be described hereinafter with reference to the drawings. Fig. 1 is an area layout in a first embodiment of the information recording medium of the present invention. In Fig. 1, the control track area, the defect management area and the user area are assigned to the information recording medium as in the conventional embodiment, and the user area is composed of rewritable areas and virtual ROM areas. A virtual ROM area, where the data record by the user has been logically prohibited, is divided into a plurality of ROM groups which have data sectors and parity sectors as in the conventional ROM area. The defect management area is composed of a disk definition area, a primary defect list area, and a secondary defect list area as in the conventional embodiment. But the area management data which are different from the conventional embodiment is recorded on the disk definition area. It is characterized in that the area management data includes the management data of the rewritable area the virtual ROM area and the ROM area assigned within the user area.

Fig. 2 is a data structure of the area management data. The area management data shown in Fig. 2 is composed of one header and four area descriptors in accordance with the data structure of Fig. 1. In order to identify that the read data are the area management data, the (OBOB) h is recorded as the data identifier in the head of the header. The disk certification flag following the header, and the management data of the primary defect list area and the secondary defect list area are the same as those to be used in the disk definition structure in the conventional embodiment. The total number of the rewritable area, the ROM area and the virtual ROM area to be assigned within the user area are recorded in the last of the header.

An area descriptor having the management data of each area is recorded, continuing to the header, in accordance with 1 : 1 with respect to the area assigned within the user area. Serial numerals showing the sequence relation within the user area are recorded at the head of the area descriptor. The area identifier is recorded so as to identify which of rewritable area/virtual ROM area/ROM area the corresponding area is, and is respectively set at the (01) in the rewritable area, at the (02) in the virtual ROM area, at the (3) in the ROM area. The area control data in the corresponding area is recorded in the last of the area descriptor. In the case of the rewritable area, the number of rewritable groups, the number of data sectors per group and the number of spare sectors per group are recorded as the area control data. Also, in the case of the virtual ROM area and the ROM area, the number of ROM groups, the number of data sectors per group and the number of parity sectors per groups are recorded as the area control data.

The information recording medium explained in Fig. 1 is a virtual ROM disk having the virtual ROM area instead of the conventional ROM area. Compared with the conventional ROM disk such virtual ROM disk is made in a shorter time period by recording the virtual ROM area with the use of the special drive unit. In case that the virtual ROM disk is used as the sample disk in the editing process of the application data, it is possible to make the sample disk for a short time and to perform the operation test immediately, application data are confirmed. Therefore, the editing process of the application data is shortened, so that the ROM disk may be easily developed. Also, when a small amount of ROM disk is required, it is possible to duplicate, distribute the virtual ROM disk, so that the lower priced ROM disk may be supplied to the user

Fig. 3 is an area layout in a secondary embodiment of the information recording medium of the present invention. Fig. 3 (a) is a physical area layout of the information recording medium, and the user area is composed of the rewritable area, the virtual ROM area and the ROM area. At this time, the area management data having three area descriptors is recorded in the disk definition area. Fig. 3 (b) is a logical data format of a partition in a case where the whole ROM area is managed as one partition. When the MS - DOS has been applied into the file management of the partition, a file allocation table (FAT), a root directory are recorded in the file management area, sub-directories and files are recorded in the file data area. Fig. 3 (c) is a logical data format of a partition in a case where the ROM area and the virtual ROM area are combined so as to compose the one new partition. The expansion of the partition by the additional recording of such virtual ROM area is used so as to replace the old file recorded in ROM area. When, for example, the file a in the ROM area is replaced by the new file b, the new FAT and the root directory together with the file b are also recorded in the virtual ROM area. As the partition starts at the head of the virtual ROM area in Fig. 3 (c), the location of other files recorded in the ROM area also have to be changed relatively. Therefore, the contents of the new FAT and the root directory to be recorded in the virtual ROM area have to be changed. The new FAT manages the file, the old FAT and the root directory in the ROM area as the unused area. As the start address and the capacity of the partition are changed, the volume control data with the management data of each partition is modified in the rewritable area or the virtual ROM area (when the rewritable area does not exist). It becomes possible to easily replace the unrewritable data on the ROM area by the formation of the new virtual ROM area within the rewritable area. Such data replacement is effective for the version up and the customization of the application data record-

ed on the ROM area.

The information recording and reproducing apparatus for making the information recording medium having the virtual ROM area, and the information recording and reproducing apparatus for carrying out the data recording and reproducing operation with the use of the information recording medium with the virtual ROM area being formed on it will be described hereinafter.

Fig. 4 is a block diagram showing one embodiment of the information recording and reproducing apparatus of the preset invention. In Fig. 4, the microprocessor 1 controls the whole information recording and reproducing apparatus 2 and also carries out the calculation of the parity data in accordance with the firmware accommodated within it. The interface control circuit 3 is connected with a host computer 5 through a host interface 4 such as SCSI so as to control the transferring of the command, the user data and so on. The memory circuit 6 is composed with the use of a RAM, and is divided therein into a data buffer for the data block to be recorded on and read from the data sector, a parity buffer for the parity block to be recorded, and read from the parity sector, a control buffer for the drive control data such as disk control data; area management data; defect list and so on. The error correcting circuit 8 adds the error correction code to the user data or the parity data stored on the memory circuit 6 in the data recording operation so as to produce the data block and the parity block, and also, detects and corrects the data error in the data reproducing operation. The optical head 9 converts the signal read from the optical disk (not shown) into the electric signal and feeds the pre-amplifier output signal 100 into the reproducing signal processing circuit 10 and the servo control circuit 11. The reproducing signal processing circuit 10 effects the analog signal processing and the digitalization of the pre-amplifier output signal 100 so as to generate the reproducing signal 101. The servo control circuit 11 controls the linear motor 12 so as to carry out the seek operation into the target track and also, performs the focus ; tracking control in accordance with the pre-amplifier output signal on the target track. The sector format control circuit 13 separates the address signal recorded on the ID field from the reproducing signal 101 so as to store the coincidence with to the target sector address. The sector format control circuit 13 demodulates the data recorded on the data field of the target sector in the data reproducing operation so as to store it on the memory circuit 6 and also, modulates the data read from the memory circuit 6 in the data recording operation so as to generate the recording signal 102. The laser driving circuit 14 drives the laser within the optical head 9 in accordance with the recording signal 102.

Fig. 5 is a data structure of the memory circuit 6. The interior of the memory circuit 6 is divided into a control buffer, a data buffer and a parity buffer. The disk control data read from the control track area, area management data from the disk definition area, defect management data from the disk definition area and command control data which the microprocessor 1 uses in the command execution are preserved in the control Buffer.

The data block to be recorded into or read from the data sector is preserved in the data buffer. The parity block to be read from the parity sector of the virtual ROM area and the ROM area are preserved in the parity block. In Fig. 5, the ROM group is composed of one track having 25 sectors, is to be assigned respectively with the sectors from 0 to 23 being provided as the data sector, and the sector 24 as the parity sector. Therefore, the data buffer is divided into 24 subareas, which includes the user data of 512 byte length to be transferred from the host computer 5, the control data of 4 byte length using the micro processor 1, and the error correction code. And the parity buffer preserved the parity data of 516 byte length to be calculated from the user data and the control data, and the error correction code.

The procedure for making the virtual ROM area within the user area by the above described information recording and reproducing apparatus 2 described will be described hereinafter in accordance with the flow chart of Fig. 6. The disk definition area is assumed to be one sector equivalent, and the area management data is assumed to be unrecorded for the simplification of the description.

(S1) The host computer 5 transfers through the host interface 4 the device command having as the control parameter including the start address and the capacity of the virtual ROM area. The interface control circuit 3 transfers the interface status 103 for informing the microprocessor 1 of the device command reception, and preserves the device command through the internal data bus 7 in the memory circuit 6. The microprocessor 1 reads the device command from the memory circuit 6 so as to preserve in the inner register the control parameter of the virtual ROM area such as the number of ROM groups, the number of data sectors per group and the number of parity sectors per group.

(S2) The microprocessor 1 prerecords in the given area of the memory circuit 6 the control data like the address to be added on the user data. Then, the microprocessor 1 transfers into the interface control circuit 3 the interface control data 104 including the data transfer mode and the data transfer length so as to start the data transfer operation. The interface control circuit 3 transfers the user data from the host computer 5 into the memory circuit 6 in accordance with the interface control data 104. Such data transferring operation is repeatedly carried out about the user data of the 24 sectors.

(S3) The microprocessor 1 calculates the parity data from the user data and the control data in accordance with the following computing formula so as to preserve it in the parity buffer. In the computing formula, the data of the byte k of the sector n is defined

as the D (n,k).

$$D(24,k) = D(0,k) * D(1,k) * \ldots * D(23,k)$$

Here the operator * shows the exclusive OR operation.

(S4) The microprocessor 1 transmits the ECC control data 105 with respect to the error correction circuit 8 so as to start the generating operation of the error correction code. As the error correcting circuit 8 reads the user data and the parity data from the memory circuit 6, and computes the error correcting code corresponding to it so as to store in the given position of the memory circuit 6. When the generating operation of such error correcting code is carried out in the sector unit with respect to 25 sectors, the error correcting circuit 8 transmits the into the microprocessor 1 the ECC status 106 meaning the completion of the operation. Then, the microprocessor 1 transfers into the servo control circuit 11 the servo control data including the target track address, and instructs the seek operation into the track into which the ROM group data of the virtual ROM area are recorded. The servo control circuit 11 transmits the linear motor driving signal 108 into the linear motor 12 and carries out the seek operation into the target track so as to transmit the servo status 109 which means the completion of the seek operation into the microprocessor 1. When the seek operation is completed, the microprocessor 1 sets in the sector format control circuit 13 the read/write control data 110 such as the operation mode of the data recording, the address of the recording data in the memory circuit 6, the target sector address and so on so as to start the data recording operation. The sector format control circuit 13 demodulates the reproducing signal 101 to separate the address signal and detects the coincidence with the target sector address. When the target sector address is detected, the sector format control circuit 13 sets the write gate signal 111 and also modulated the recording data read from the memory circuit 6 and transmits into the laser driving circuit 14 the recording signal 102. At this time, the laser driving circuit 14 transmits the laser driving signal 112 modulated by the recording signal 102 so as to record the data on the data field of the target sector. Such data recording operation is carried out with respect to the twenty five sectors. Finally, the sector format control circuit 13 transmits into the microprocessor 1 the read/write status 113 for meaning the completion of the data recording operation.

(S5) When the data recording of the ROM group has been completed, the microprocessor 1 compares the number of ROM groups assigned into the virtual ROM area with the number of ROM groups completed in the data recording operation so as to judge whether or not the whole data recording operation has been completed. If the unrecorded ROM group exists, the microprocessor 1 returns to the procedure (S2) again so as to execute the data recording operation with respect to the next ROM group.

(S6) When the data recording operation with respect to the whole virtual ROM area has been completed, the microprocessor 1 generates the area management data having the area descriptor of the virtual ROM area as shown in Fig. 2 from the control parameter preserved in the inner register so as to record within the memory circuit 6. Then, the microprocessor 1 records the area management data in the disk definition area as in the data recording operation described at the procedure (S4). When the recording operation of the area management data is completed, the microprocessor 1 transfers the interface control data 104 which means the command completion into the host computer 5.

By the above described processing procedure, one virtual ROM area is formed within the user area, and the area management data with the management data of the virtual ROM area being retained is recorded in the disk definition area. When the second and its subsequent virtual ROM areas are formed, the area management data is recorded already in the disk definition area. Accordingly, the microprocessor 1 at this time reads from the memory circuit 6 the area management data recorded in the disk definition area so as to add the management data of the new virtual ROM area so as to record in the disk definition area the renewed area management data.

The procedure of the data read and write operation which is performed by the information recording and reproducing apparatus using the information recording medium with the virtual ROM area, will be described hereinafter in accordance with the flow chart of Fig. 7.

(S7) When the host computer 5 transfers the device command, the microprocessor 1 reads the device command from the memory circuit 6 as in the procedure (S1), preserves in the inner register the operation code, the address for executing the data recording or reproducing operation and the control parameter such as the number of sectors. The microprocessor 1 starts the servo control circuit 11 as described in the procedure (S4) executes seek operation into the disk definition area. The microprocessor 1 sets the operation mode for the data reproduction, the target sector address and so on in the sector format control circuit 13 so as to start the data reproducing operation. The sector format control circuit 13 demodulates the reproducing signal from the data field of the target area, preserves the read data in the memory circuit 6. Further, the microprocessor 1 starts the error correcting circuit 8 so as to correct the data error to be included in the read data.

When the error correction processing is completed, the microprocessor 1 reads the area management data from the memory circuit 6 so as to preserve it therein.

(S8) The microprocessor 1 judges whether the device command is a write command or a read command from the operation code preserved in the inner register in the procedure (S7).

(S9) When the device command is a write command, the microprocessor 1 inspects from the contents of the area management data whether or not the data recording area is included in the ROM area or the virtual ROM area where the data recording operation is prohibited.

(S10) When the data recording area is in the ROM area or the virtual ROM area, the microprocessor 1 sets in the interface control circuit 3 the interface control data 104 meaning the write protect error so as to transfer it into the host computer 5 so as to abort the command execution.

(S11) When the data recording area is in the rewritable area, the microprocessor 1 adds the control data to the user data transferred from the host computer 5 as in the procedure (S2). Further, the microprocessor 1 adds the error correcting code to generate the data block as in the procedure (S4), and records it in the data recording area in a sector unit. When the data recording operation with respect to the whole data recording area is completed, the microprocessor 1 transfers into the host computer 5 the interface control data 104 which means the command completion so as to complete the command execution.

(S12) When the device command is a read command, the microprocessor 1 inspects from the contents of the area management data whether or not the data reproducing area is included in the ROM area or in the virtual ROM area.

(S13) When the data reproducing area is included in the ROM area or in the virtual ROM area, the microprocessor 1 executes as follows the data reproducing operation of the ROM group unit. The microprocessor 1 starts the servo control circuit 11 so as to execute the seek operation into the target track assigned in the ROM group. Then, the microprocessor 1 starts the sector format control circuit 13 so as to execute the data reproducing operation of the each sector to be included in the ROM group, and preserves the read data in the memory circuit 6.

(S14) The microprocessor 1 transfers the ECC control information 105 with respect to the error correcting circuit 8 so as to start the error correcting processing. The error correcting circuit 8 reads the data in a sector unit from the memory circuit 6, and performs the dror correcting process with the use of the error correcting code. When the uncorrectable error has been detected in the error correction processing, the error correcting circuit 8 transfers into the microprocessor 1 the ECC status 106 including the address of the defective sector detected in the uncorrectable error. Such error correcting processing is carried out about the whole sector to be included in the ROM group.

(S15) The microprocessor 1 judges from the contents of the ECC status 106 whether or not the defective sector is a data sector or a parity sector When, for example, the sector 0 which is the data sector is a defective sector, the microprocessor 1 computes the user data of the defective sector in accordance with the next computing formula with the use of the data read from the other 24 sectors to be included in the ROM group so as to preserve in the memory circuit 6.

$$D(0,k) = D(1,k) * D(2.k) *...* D(24.k)$$

When the parity sector only is a defective sector, the microprocessor 1 does not performs such parity operation as described hereinabove.

(S16) The microprocessor 1 sets in the interface control circuit 3 the interface control information 104 including the data transfer mode and the data transfer length so as to start the data transfer operation. The interface control circuit 3 transfers into the host computer 5 in the sector unit the user data preserved in the memory circuit 6.

(S17) When the data reproducing operation of the data sector within the ROM group has been completed, the microprocessor 1 compares the number of ROM groups to be included in the data reproducing area with the number of ROM groups completed in the data reproducing operation so as to judge whether or not the reproducing operation of the whole data reproducing area haas been completed. If the unprocessed ROM group exists, the microprocessor 1 returns to the procedure (S13) so as to execute the data reproducing operation with respect to the next ROM group.

When the data reproducing operation of the whole data reproducing area is completed, the microprocessor 1 transfers the interface control data 104 which means the command completion into the host computer 5 so as to complete the command execution.

(S18) When the data reproducing area is included in the rewritable area, the microprocessor 1 starts the servo control circuit 11 so as to carry out the seek operation into the target track where the start sector of the data reproducing area is located. The microprocessor 1 starts the sector format control circuit 13 so as to execute the data reproducing operation of each data sector specified in the data reproducing area and starts the error correcting circuit 8 so as to execute the error correction processing. The microprocessor 1 starts the interface control

circuit 3 so as to transfer into the host computer 5 from the memory circuit 6 the user data read from the data reproducing area, and further transmits into the host computer 5 the interface control data 104 which means the command completion so as to complete the command execution.

In accordance with the above described processing procedure, the data read and write operation using the information recording medium with the virtual ROM area is carried out. In the above described procedure (S13), the data reproducing operations of the data sector and the parity sector have been performed at the same time in the ROM group unit. There is such a processing procedure as to carry out the data reproducing operation of the parity sector, only when the defective sector has been detected with the data reproducing operation of the data sector. In the processing procedure (S15), the one defective sector is assumed to be detected from the ROM group. If two defective sectors or more have been detected from the same ROM group, the microprocessor 1 judges that the error recovery is impossible to perform. The interface control data 104 which means the detection of the unrecovered error is transferred into the host computer 5 to abort the command execution.

In the processing procedures (S3) and (S15) described so far, the microprocessor 1 has executed the computing processing of the parity data and the recovering processing of the data error using the parity data by the firmware accommodated therein, but it is also possible to execute the computation with the use of the hardware as in the error correcting code. In the above described processing procedure, the ROM group composed of data blocks of the 24 sectors and the party sector. It is possible to cope with the larger ROM group in capacity and to process a plurality of ROM group data at one time by the use of the memory circuit 6 having the larger capacity.

Claims

1. A disk shaped information recording medium in which information is recorded or reproduced in sectors, comprising

   a disk definition area and a user area;
   the disk definition area for recording area management data for the user area;
   the user area comprising at least a ROM area,

   characterized in that the ROM area is a virtual ROM area, in which data recording is possible only by a special drive but is prevented from being used for data recording by a user, said virtual ROM area being assigned in the recordable user area, but having the same logical data structure as a ROM format;
   wherein said area management data containing the management information of said vitual ROM area is recorded in the disk definition area.

2. An information recording medium in accordance with claim 1, the user area further comprising an additional actual ROM area being physially not rewritable.

3. An information recording medium in accordance with claim 1, wherein said virtual ROM area is divided into ROM groups including a plurality of data sectors where user data is recorded, and a parity block where parity data computed from said user data is recorded.

4. An information recording medium in accordance with claim 2,
   wherein said management data is composed of a header including management data of the entire information recording medium, and area desciptors of rewritabel areas, said virtual ROM area and said actual ROM area.

5. An information recording and reproducing apparatus which is connected to a host computer, and performs write operations in a virtual ROM area of a disk-shaped information recording medium according to one of claims 1-4, comprising:

   a data transferring means for transferring (S1, S2) a device command and the user data; an area assigning means for assigning a virtual ROM area into a rewritable user area and for producing the area management data including management data of the virtual ROM area; a parity computing means for computing (S3) parity data;
   an error correction code producing means for producing (S4) a data block and a parity block with the addition of error correction codes; a data preserving means for temporarily preserving the data block, the parity block and drive control data including the area management data; a data recording means for respectively recording the data block and the parity block on the virtual ROM area and for also recording the area management data on a disk definition area.

6. An information recording and reproducing apparatus in accordance with claim 5, wherein said parity operating means generates the parity data using a microprocessor.

7. An information recording and reproducing apparatus which is connected to a host computer, and performs read/write operations with respect to a disk-shaped information recording medium according to one of claims 1-4. comprising: a data transfer

means for transferring (S7) a device command and user data; a data reproducing means for reading the area management data from the disk definition area, means for reading (S18) a data block from rewritable areas; a write prohibiting means for prohibiting (S9, S10) a data recording operation into the virtual ROM area in response to said management information; means for reading (S13) data blocks and parity blocks from ROM areas; an error detecting and correcting means for performing error correction (S14, S15) with respect to the data block and the parity block and also, and for detecting a defective sector having an uncorrectable error; and a data recovering means for operating upon user data from the defective sector.

8. An information recording and reproducing apparatus in accordance with claim 7, wherein said data recovering means generates the user data of the defective sector using a microprocessor.

Patentansprüche

1. Plattenförmiges Informationsaufzeichnungsmedium, auf welchem Informationen in Sektoren aufgezeichnet oder wiedergegeben werden, mit einem Platten-Definitionsbereich und einem Benutzer-Bereich;

   wobei der Platten-Definitionsbereich zum Aufzeichnen von Bereichs-Verwaltungsdaten für den Benutzer-Bereich vorgesehen ist;
   wobei der Benutzer-Bereich wenigstens einen ROM-Bereich umfaßt,

   dadurch gekennzeichnet, daß der ROM-Bereich ein virtueller ROM-Bereich ist, in welchem eine Datenaufzeichnung nur mit einem bestimmten Laufwerk möglich ist, aber verhindert wird, daß er zur Datenaufzeichnung von einem Benutzer genutzt wird, wobei der virtuelle ROM-Bereich in dem beschreibbaren Benutzer-Bereich zugeordnet ist, aber die gleiche logische Datenstruktur aufweist, wie ein ROM-Format;
   wobei die Bereichs-Verwaltungsdaten, welche die Verwaltungsinformation des virtuellen ROM-Bereiches umfassen, in dem Platten-Definitionsbereich aufgezeichnet sind.

2. Informationsaufzeichnungsmedium nach Anspruch 1,
   bei welchem der Benutzer-Bereich weiterhin einen zusätzlichen tatsächlichen ROM-Bereich umfaßt, der physikalisch nicht überschreibbar ist

3. Informations-Aufzeichnungsmedium nach Anspruch 1,
   bei welchem der virtuelle ROM-Bereich in ROM-Gruppen mit mehreren Datensektoren aufgeteilt ist, in welchen Benutzerdaten aufgezeichnet werden, und einen Paritätsblock, in welchem die aus den Benutzerdaten berechneten Paritätsdaten aufgezeichnet werden.

4. Informationsaufzeichnungsmedium nach Anspruch 2,
   bei welchem die Verwaltungsdaten aus einem Kopf mit Verwaltungsdaten des gesamten Informationsaufzeichnungsmediums und Bereichs-Deskriptoren überschreibbarer Bereiche, des virtuellen ROM-Bereiches und des tatsächlichen ROM-Bereiches gebildet sind.

5. Informations-Aufzeichnungs- und Wiedergabevorrichtung,
   welche an einen Host-Computer angeschlossen ist und Schreiboperationen in einem virtuellen ROM-Bereich eines plattenförmigen Informationsaufzeichnungsmediums nach einem der Ansprüche 1 bis 4 ausführt, mit:
   einer Datenübertragungseinrichtung zum Übertragen (S1, S2) eines Gerätebefehls und der Benutzerdaten; einer Bereichs-Zuordnungseinrichtung zum Zuordnen eines virtuellen ROM-Bereiches in einem überschreibbaren Benutzerbereich und zum Erzeugen der Bereichs-Verwaltungsdaten einschließlich der Verwaltungsdaten des virtuellen ROM-Bereiches; einer Parität-Berechnungseinrichtung zum Berechnen (S3) von Paritätsdaten; einer Fehlerkorrekturcode-Erzeugungseinrichtung zum Erzeugen (S4) eines Datenblocks und eines Paritätsblocks mit der Hinzufügung der Fehlerkorrekturcodes; einer Daten-Zwischenspeichereinrichtung zum vorübergehenden Zwischenspeichern des Datenblocks, des Paritätsblocks und der Laufwerks-Steuerungsdaten mit den Bereichs-Verwaltungsdaten; einer Datenaufzeichnungseinrichtung zum entsprechenden Aufzeichnen des Datenblocks und des Paritätsblocks in dem virtuellen ROM-Bereich und um ebenfalls die Bereichs-Verwaltungsdaten in einem Platten-Definitionsbereich aufzuzeichnen.

6. Informations-Aufzeichnungs- und Wiedergabe-Vorrichtung nach Anspruch 5,
   bei welcher die Paritäts-Operationseinrichtung die Paritätsdaten unter Verwendung eines Mikroprozessors erzeugt.

7. Informations-Aufzeichnungs- und Wiedergabe-Vorrichtung,
   welche an einen Host-Computer angeschlossen ist und Lese/Schreib-Operationen für ein plattenförmiges Informationsaufzeichnungsmedium nach einem der Ansprüche 1 bis 4 ausführt, mit:

einer Datenübertragungseinrichtung zum Übertragen (S7) eines Gerätebefehls und von Benutzerdaten;
einer Daten-Wiedergabeeinrichtung zum Lesen der Bereichs-Verwaltungsdaten aus dem Platten-Definitionsbereich, einer Einrichtung zum Lesen (S18) eines Datenblocks aus überschreibbaren Bereichen;
einer Schreib-Unterbindungseinrichtung zum Unterbinden (S9, S10) eines Datenaufzeichnungsvorgangs in dem virtuellen ROM-Bereich als Reaktion auf die Verwaltungsinformation;
einer Einrichtung zum Lesen (S13) von Datenblöcken und Paritätsblöcken aus den ROM-Bereichen;
einer Fehler-Erfassungs- und Korrektur-Einrichtung zum Ausführen einer Fehlerkorrektur (S14, S15) für den Datenblock und den Paritätsblock und zum Erfassen eines defekten Sektors mit einem unkorrigierbaren Fehler;
und einer Daten-Wiederherstellungseinrichtung zum Arbeiten mit Benutzerdaten aus dem defekten Sektor.

8. Informations-Aufzeichnungs- und Wiedergabe-Vorrichtung nach Anspruch 7,
bei welcher die Daten-Wiederherstellungseinrichtung die Benutzerdaten des defekten Sektors unter Verwendung eines Mikroprozessors erzeugt.

Revendications

1. Support d'enregistrement d'informations en forme de disque dans lequel des informations sont enregistrées ou reproduites dans des secteurs, comprenant une zone enregistrable et une zone de l'utilisateur pour l'enregistrement des données de l'utilisateur,

une zone de définition de disque pour l'enregistrement de données de gestion à affecter à l'intérieur de ladite zone de l'utilisateur,
la zone de l'utilisateur comprenant au moins une zone réinscriptible et une zone de mémoire morte (ROM),

caractérisé en ce que la zone de mémoire morte est une zone de mémoire morte virtuelle, dans laquelle l'enregistrement des données n'est possible qu'avec un lecteur particulier, mais que l'on empêche d'être utilisée pour l'enregistrement des données par un utilisateur, ladite zone de mémoire morte virtuelle, étant physiquement de même conception que celle de la zone de l'utilisateur enregistrable, mais comportant des secteurs dans un format de mémoire morte.

dans lequel les informations de gestion de zone contenant les informations de gestion de ladite zone de mémoire morte virtuelle sont enregistrées dans la zone de définition de disque.

2. Support d'enregistrement d'informations selon la revendication 1, la zone de l'utilisateur comprenant en outre une zone de mémoire morte réelle supplémentaire qui n'est pas physiquement réinscriptible.

3. Support d'enregistrement d'informations selon la revendication 1, dans lequel ladite zone de mémoire morte virtuelle est partagée en groupes de mémoire morte comprenant une pluralité de secteurs de données où sont enregistrées les données de l'utilisateur, et un bloc de parité où sont enregistrées des données de parité calculées d'après lesdites données de l'utilisateur.

4. Support d'enregistrement d'informations selon la revendication 2

dans lequel lesdites données de gestion sont composées d'un en-tête comprenant des données de gestion du support d'enregistrement d'informations entier, et de descripteurs des zones réinscriptibles, de ladite zone de mémoire morte virtuelle et ladite zone de mémoire morte réelle.

5. Appareil d'enregistrement et de reproduction d'informations qui est relié à un ordinateur hôte, et exécute des opérations d'écriture dans une zone de mémoire morte virtuelle d'un support d'enregistrement d'informations en forme de disque selon l'une des revendications 1 à 4 comprenant :

un moyen de transfert de données destiné à transférer (S1, S2) un ordre de dispositif et les données de l'utilisateur, un moyen d'affectation de zone destiné à affecter une zone de mémoire morte virtuelle dans une zone de l'utilisateur réinscriptible et à produire les données de gestion de zone comprenant des données de gestion de la zone de mémoire morte virtuelle, un moyen de calcul de parité destiné à calculer (S3) des données de parité, un moyen de production de code de correction d'erreur destiné à produire (S4) un bloc de données et un bloc de parité en ajoutant des codes de correction d'erreur, un moyen de préservation de données destiné à préserver temporairement le bloc de données, le bloc de parité et des données de commande de lecteur comprenant les données de gestion de zone, un moyen d'enregistrement des données destiné à enregistrer respectivement le bloc de données et le bloc de parité sur la zone de mémoire morte virtuelle et à également enregistrer les données de gestion de zone sur une zone de définition de disque.

6. Appareil d'enregistrement et de reproduction d'informations selon la revendication 5, dans lequel ledit moyen d'opération sur la parité génère les don-

nées de parité en utilisant un microprocesseur.

7. Appareil d'enregistrement et de reproduction d'informations qui est relié à un ordinateur hôte, et exécute des opérations de lecture/écriture en fonction d'un support d'enregistrement d'informations en forme de disque selon l'une des revendications 1 à 4, comprenant :

un moyen de transfert des données destiné à transférer (S7) un ordre du dispositif et des données de l'utilisateur, un moyen de reproduction des données destiné à lire les données de gestion de zone à partir de la zone de définition de disque, un moyen destiné à lire (S18) un bloc de données à partir des zones réinscriptibles, un moyen d'interdiction d'écriture destiné à interdire (S9, S10) une opération d'enregistrement des données dans la zone de mémoire morte virtuelle en réponse auxdites informations de gestion, un moyen destiné à lire (S13) des blocs de données et des blocs de parité à partir des zones de mémoire morte, un moyen de détection et de correction d'erreur destiné à exécuter une correction d'erreur (S14, S15) en fonction du bloc de données et du bloc de parité et, également, destiné à détecter un secteur défectueux comportant une erreur non corrigeable, et un moyen de récupération des données destiné à agir sur des données de l'utilisateur provenant du secteur défectueux.

8. Appareil d'enregistrement et de reproduction d'informations selon la revendication 7, dans lequel ledit moyen de récupération des données génère les données de l'utilisateur du secteur défectueux en utilisant un microprocesseur.

Fig. 1

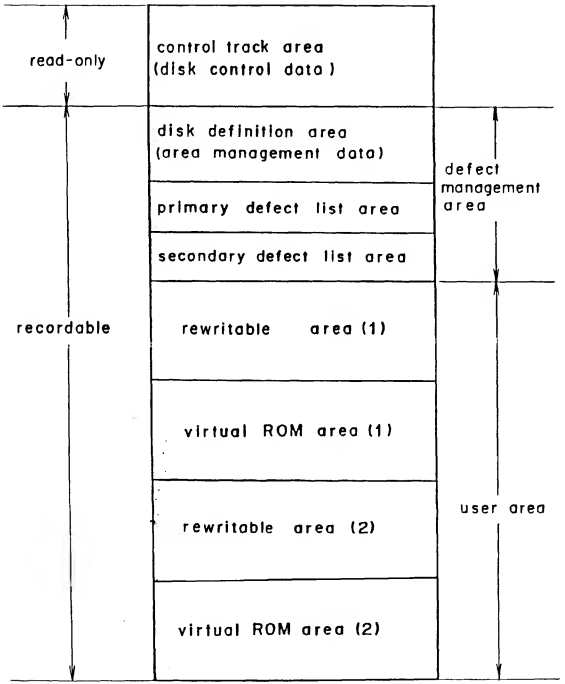
read-only
recordable
control track area
(disk control data)
disk definition area
(area management data)
primary defect list area
secondary defect list area
defect
management
area
rewritable area (1)
virtual ROM area (1)
rewritable area (2)
virtual ROM area (2)
user area

Fig. 2

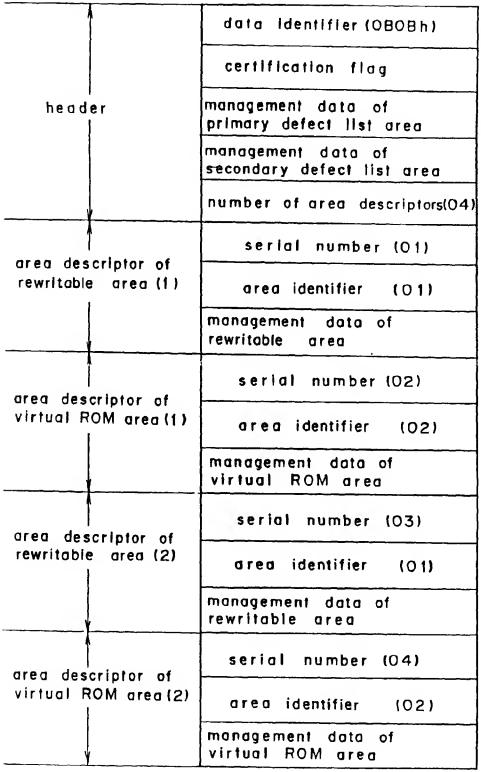
header
data identifier (0B0Bh)
certification flag
management data of primary defect list area
management data of secondary defect list area
number of area descriptors(04)
area descriptor of rewritable area (1)
serial number (01)
area identifier (01)
management data of rewritable area
area descriptor of virtual ROM area (1)
serial number (02)
area identifier (02)
management data of virtual ROM area
area descriptor of rewritable area (2)
serial number (03)
area identifier (01)
management data of rewritable area
area descriptor of virtual ROM area (2)
serial number (04)
area identifier (02)
management data of virtual ROM area

Fig. 3

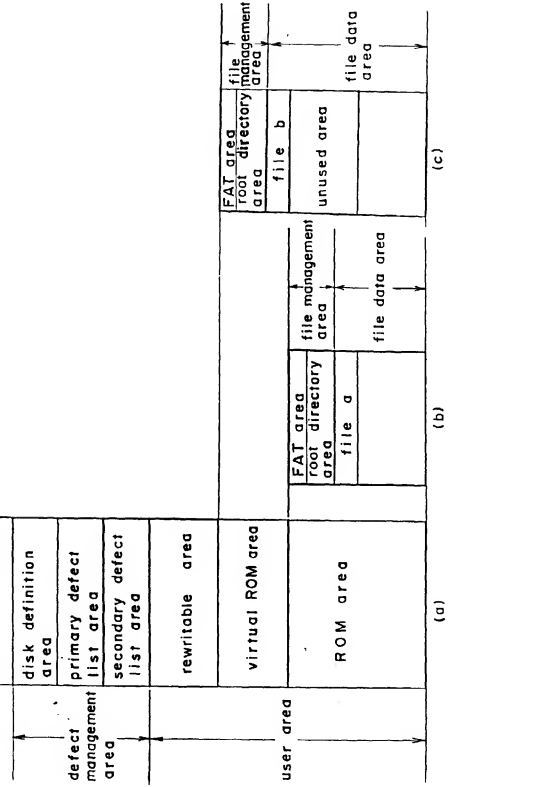
control track area
disk definition area
primary defect list area
secondary defect list area
rewritable area
virtual ROM area
defect management area
user area
ROM area
FAT area
root directory area
file a
file management area
file data area
FAT area
root directory area
file b
unused area
file management area
file data area
(a)
(b)
(c)

Fig. 4

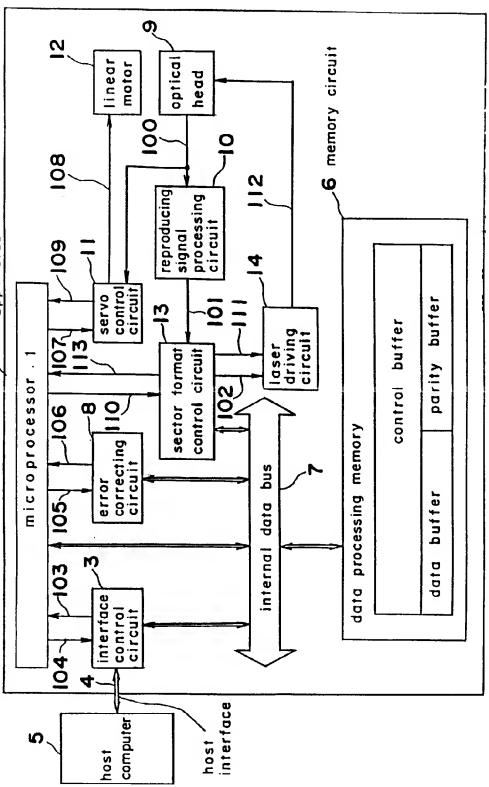
2 information recording and reproducing apparatus
microprocessor 1
interface control circuit
3
4
host interface
5
host computer
104
103
105
error correcting circuit
8
106
110
107
113
servo control circuit
11
109
108
12
linear motor
9
optical head
100
10
reproducing signal processing circuit
112
6 memory circuit
14
laser driving circuit
111
13
sector format control circuit
101
102
internal data bus
7
data processing memory
control buffer
data buffer
parity buffer

Fig. 5

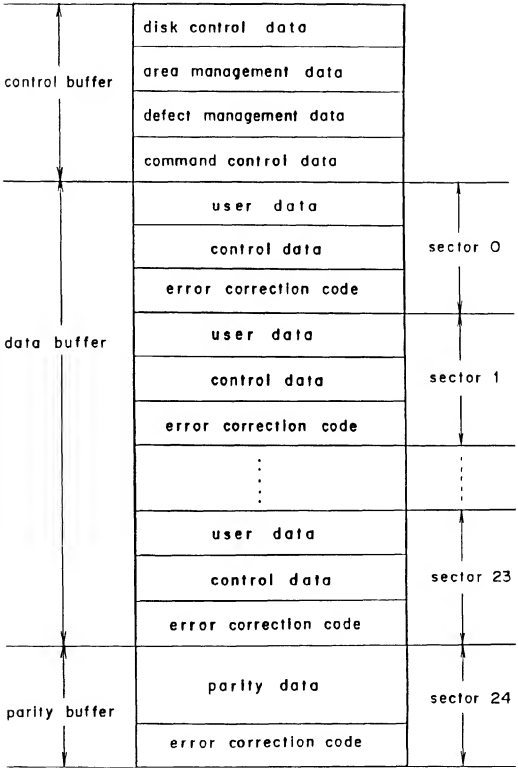
control buffer
data buffer
parity buffer
disk control data
area management data
defect management data
command control data
user data
control data
error correction code
user data
control data
error correction code
user data
control data
error correction code
parity data
error correction code
sector 0
sector 1
sector 23
sector 24

Fig. 6

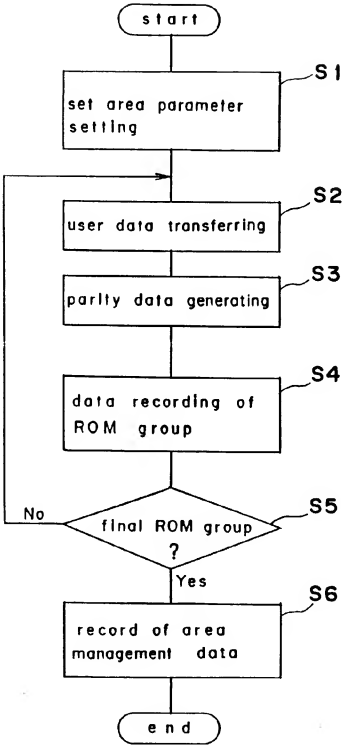
start
S1
set area parameter setting
S2
user data transferring
S3
parity data generating
S4
data recording of ROM group
No
final ROM group ?
S5
Yes
S6
record of area management data
end

Fig. 7

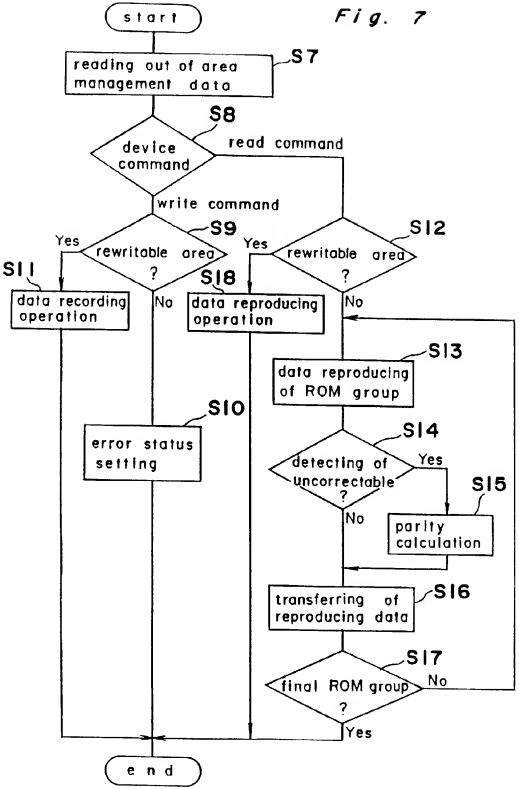
start
reading out of area management data
S7
S8
device command
read command
write command
S9
rewritable area ?
Yes
S12
rewritable area ?
Yes
S11
data recording operation
No
S18
data reproducing operation
No
S13
data reproducing of ROM group
S10
error status setting
S14
detecting of uncorrectable ?
Yes
S15
parity calculation
No
S16
transferring of reproducing data
S17
final ROM group ?
No
Yes
end

Fig. 8 PRIOR ART

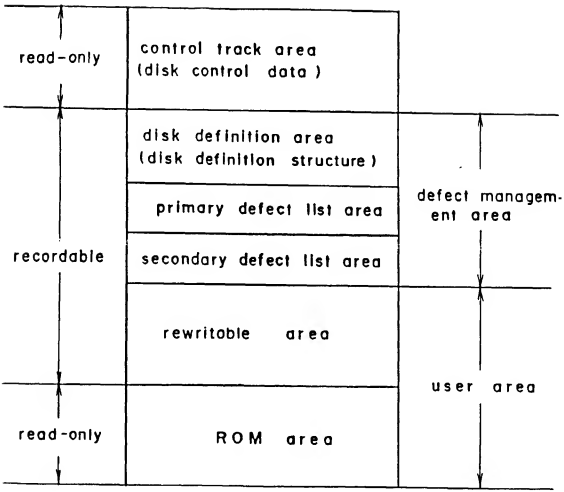

Fig. 9 PRIOR ART

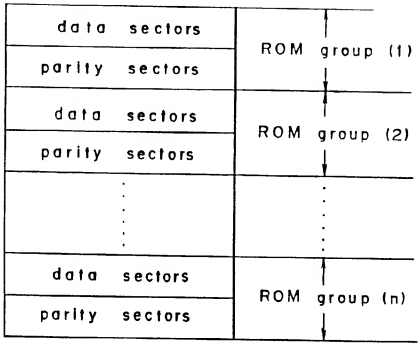

Fig. 10

data identifier (0A0Ah)
certification flag
management data of rewritable area
management data of ROM area
management data of primary defect list area
management data of secondary defect list area